

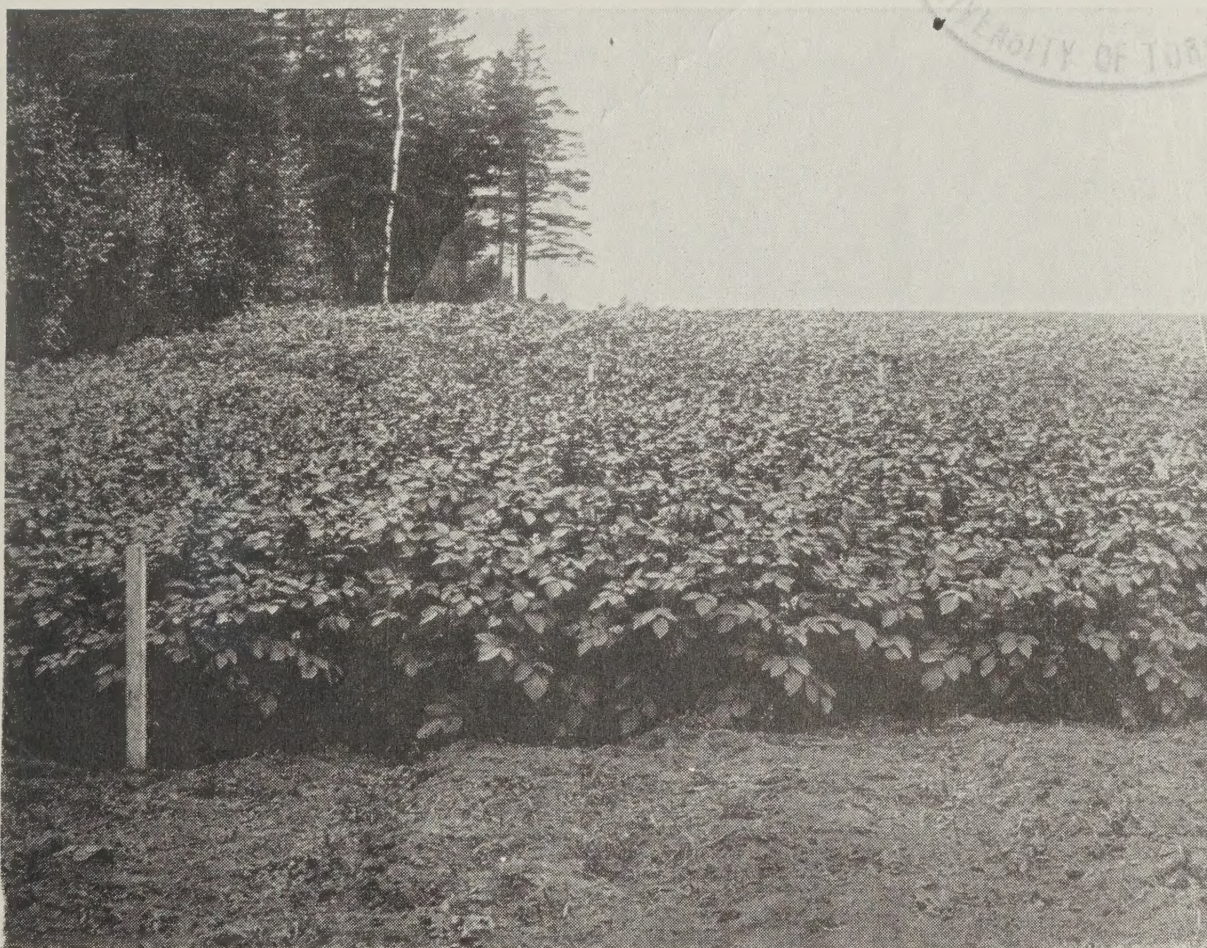
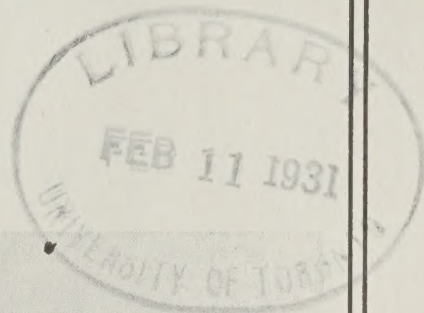
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Canadian Certified Seed Potatoes

Rules and Regulations Governing Their Production

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PLANT CERTIFIED SEED FOR MORE AND BETTER POTATOES

DOMINION OF CANADA
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CANADIAN CERTIFIED SEED POTATOES

Rules and Regulations Governing their Production

INTRODUCTION

Whether potatoes are grown for seed purposes or table stock it is essential that high grade seed be used, since good seed is the basis of good crops and profitable markets. Good seed potatoes may be defined as tubers grown in suitable soil; produced on healthy, vigorous, well cared for plants; of good type; stored under suitable conditions, and reasonably free from mechanical and insect injuries. Such seed may cost a little more, but is, without a doubt, more profitable to use.

Potatoes are subject to many diseases, some of which are apparent on the tuber, others in the tubers after they are cut, and other (virus diseases) only while the plants are growing. Apparent soundness of the tubers constitutes no guaranty of freedom from disease, for notwithstanding good appearance they may carry disease which seriously affects the yield. Leaf roll, mosaic and other virus diseases, although not recognizable in the tubers, nevertheless cause severe losses.

It is apparent, therefore, that careful inspection of the individual growing plants is essential to detect certain diseases, lack of vigour, poor stands, mixtures, etc., and it was in order to aid in the production of profitable crops by the use of disease-free seed that the Dominion Botanist in 1915 organized a system of certification based on field inspections and very concise general regulations.

The Inspection service was started in a small way first in New Brunswick and Prince Edward Island and the practical value of the work was soon evident. The response on the part of the potato growers to the offer of the department to inspect good fields, with a view to certification, was most gratifying, and the service was extended, proportionate to the demand, until every province was included.

A total of 3,956 acres passed inspection in 1920. This made available a large quantity of seed for domestic requirements and in addition 75 carlots were exported. Canadian certified seed quickly made a favourable impression in foreign markets and the export trade now requires $1\frac{1}{2}$ million bushels annually. In 1930 a total of 34,000 acres were inspected throughout the Dominion, and certified seed production totalled approximately five million bushels.

Good quality and high yields prevent serious losses in those years when prices are low and assure greater profits in good price years. The yield of good marketable potatoes per acre and the price per bushel determine the profit; not the total production but the yield above the per-acre cost of producing and marketing the crop—that is profit.

The average yield of potatoes in Canada is approximately 133 bushels per acre (1920-1929, Dominion Bureau of Statistics); the average yield for certified seed is estimated at 275 bushels per acre, for the same period (from inspectors' reports). Many growers annually report their certified seed crop to exceed 400 bushels per acre.

Meaning of Certification

Certification is a means of recording seed stock that is of good type, from vigorous plants, and, as far as practical under advanced conditions of farming, relatively free from serious diseases. When potatoes have been inspected in the field and after harvest by an authorized officer of the Dominion Department of Agriculture, and have been found to be vigorous and to conform to the standards set of freedom from serious diseases and of purity of variety, they may be certified. Official tags are issued for such seed stocks exclusively.

Official Certified Seed Potato Tags

The official tags in use are illustrated here. These alone constitute the guarantee that Canadian certified seed potatoes are being dealt with.



"This tag has been issued to the grower on the date shown on the front of the tag for one container of potatoes, and is to certify that satisfactory evidence has been given that the contents have been grown by the person whose certificate number it bears, and that they have been inspected in the field and after harvest by an officer of the Dominion Department of Agriculture and have been found to be sufficiently vigorous and free from serious diseases, pests and foreign varieties to warrant them being classed as GRADE EXTRA No. 1 SEED POTATOES."

"This tag has been issued on the express condition that the person to whom it is issued and whose certificate number it bears, undertakes to grade the potatoes for which it is to be used so that they shall be practically free from rotted or other seriously injured, foreign or off-type tubers, and that not more than five per cent by weight shall be below three ounces or above twelve ounces, and on the further condition that the said person assumes entire responsibility for the contents of any package to which this tag may be attached by him."

"THE ORIGINAL PURCHASERS OF CERTIFIED SEED POTATOES ARE REQUESTED TO EXAMINE THEIR POTATOES AT ONCE AND LODGE ANY COMPLAINTS FORTHWITH. AFTER BEING KEPT IN UNSUITABLE STORAGE FOR ANY LENGTH OF TIME, NO GUARANTEE CAN BE GIVEN AS TO THEIR QUALITY."

Yellow-coloured tags for "Irish Cobbler" variety. Green-coloured tags for "Green Mountain" variety. Buff manilla tags for all other varieties. In addition there is a blue-coloured tag similar in design to the others but worded "Certified Seed Potatoes Grade Small Sized 1½-3 ounces only".

One of these tags must be attached to each container of certified seed potatoes. No other type of label carries any official recognition of seed potatoes whatsoever, and purchasers are seriously warned, that if they accept delivery of potatoes in containers that do not bear the tag as illustrated herewith, they are not receiving Canadian Government certified seed. Unfortunately on many occasions other tags have been used to mislead an unsuspecting public. The official tags show the certificate number of the field from which the potatoes were taken and upon application to the Dominion Botanist or to District Inspectors a copy of the field readings of any individual producer will be sent.

STEPS NECESSARY TO OBTAIN CERTIFICATION

Early in spring an application form should be obtained from the Dominion Botanist, Central Experimental Farm, Ottawa, or from the nearest district inspector. (The list of inspectors is given on page 10). This form should be filled in and returned in a stamped envelope to the nearest district inspector. All applications must be made on or before June 15, on which date the lists are closed. No inspection can be guaranteed after this date. Application forms received after June 15 will be returned to the sender with a note advising him that the lists are closed and his application is cancelled, unless very exceptional conditions warrant an extension.

Regulations Governing Certification

The seed used in planting the crop for which certification is desired must have been taken from stock which passed both field and tuber inspections the previous year. Any variety, however, which is correctly named may be certified after passing all inspections for two years in succession. Seed should, even then, be of desirable type for the variety entered, and should be as free as possible from scab and rhizoctonia, or be treated before planting.

Potatoes intended for inspection and certification must be planted at least 200 feet from other (uncertified) potatoes. This is to avoid possible transmission of disease by aphids, etc. Disregard of this ruling has led to the rejection of many fields.

No fields which upon first field inspection have more diseases than are permitted in the standard, or show insufficient growth and vigour, or any field showing poor stand, will be given a second inspection or further consideration for certification.

Fields should be kept well cultivated and sprayed for blight and insects. Weedy, poorly cultivated fields, and those showing many plants stripped by insects are liable to be disqualified.

Seed potatoes must be dug and handled with the greatest care to prevent unnecessary bruising or they may spoil in storage. They must be kept from danger of frost injury. Tubers exposed to frost injury will not be certified.

First field inspection will commence about six or seven weeks after the average planting date for the district. Second inspection will follow within four weeks.

After field inspections are completed, growers will be notified by card if their fields have passed. The return of the card to the district inspector will ensure their receiving tuber inspection. In the case of a field failing to pass the field inspection, grower is notified of this fact by letter and the crop is **not** considered further for certification.

Tuber inspection will commence at digging time, or as soon after as possible, and continue until all who qualify and apply for tuber inspection have been visited.

NOTE.—Seed-potato growers who desire inspection and certification should have a seed-plot and practise tuber unit methods for maintaining the quality of their stock. The chief value of this method is the elimination of weak, unproductive plants, virus diseases, and varietal mixtures.

Tuber unit method means planting selected tubers one at a time in succeeding hills. Tubers of a limited range of weight are desirable. To permit tuber-units all to be made of the same number of hills and have the seed-pieces uniform in size, 7-9 ounce tubers are considered best for the purpose. The tuber is cut lengthwise through its central axis into two equal parts, cutting through the cluster of eyes at the terminal end, then cross-wise, forming four blocky seed-pieces. The quarters are planted consecutively, a double space being left between each tuber. The appearance of the plants will likely present many marked differences between the various units. The tuber-units should receive careful study for the presence of diseased or abnormal plants, and only those which are most uniform, vigorous, and healthy should be retained. This seed-plot should be given extra care and attention in cultivation, roguing, spraying, and particularly, in the control of all insects.

DOMINION OF CANADA INSPECTION STANDARDS FOR CERTIFIED SEED POTATOES

Field

	1st inspection	2nd inspection
	%	%
Blackleg..	3	1
Leaf roll..	2	1
Mosaic..	2	1
Spindle tuber..	2	1
Wilts..	3	2
Foreign..	1	$\frac{1}{2}$

Providing that in no case shall a total of more than 6 per cent disease collectively be allowed on first inspection or more than 3 per cent on second inspection.

Tuber

Tags to be issued by inspector only on the express understanding that tubers must contain no more of the diseases, etc., than provided under the following standard when shipped:—

	%
Wet rot (bacterial)	$\frac{1}{2}$
Late blight and dry rot	1
Scabs—rhizoctonia—(Silver Scurf)	
Slight	10
Severe	5
Necrosis, wilts, and internal discolourations, other than due to variety.	5

Providing that in no case (unless otherwise provided) shall a total of more than 7 per cent be allowed except in the case of slight scab or rhizoctonia.

Not more than 1 per cent of powdery scab allowed under scabs.

Not more than 2 per cent of the tubers to be malformed, or spindly, or badly damaged by sunburn, cuts, cracks, bruises, insects, etc.

No frost or foreign tubers shall be allowed.

Not more than 5 per cent by weight of the tubers shall be below 3 ounces or above 12 ounces in the Extra No. 1 Grade. Not more than 3 per cent by weight of the tubers shall be below 1½ ounces or above 3 ounces in the Certified small size seed grade.

At fall bin-inspection, if more than 3 per cent late blight be found in bin, final certificate will be withheld and the grower will not be allowed to grade for fall shipment but may hold for spring shipment, subject to re-inspection.

Growers should allow at least ten days in storage before attempting to grade for shipment or serious consequences may later result from spoilage.

Seed stocks improperly stored, as indicated by excessive sprouting or shrivelling, will be refused certification.

Practices Essential to Successful Potato Production

Always practise up-to-date crop rotation and thereby maintain a proper balance between the mineral elements of the soil and restrain the developments of injurious fungous and insect pests.

The largest crops are produced on shaly or gravelly loam; sandy loam usually produces a better quality and cleaner, brighter sample than the heavier types of soil.

A good, deep, mellow seed-bed is essential to type. Keep plenty of humus in the soil by ploughing down clovers, etc. where possible. A clover sod ploughed deep and well worked will give good results.

The physical and mechanical conditions of the soil are as important as fertility, but potatoes need rich soil for their best development. Fertilize freely.

Thorough seed-bed preparation kills weeds and many disease germs, aerates the soil, etc.; the sun's action kills spores of some diseases. No amount of after tillage can overcome neglect in preparation.

Do not apply fresh manure to potato land in the spring, or plant potatoes on soil which has received much lime or wood ashes in recent years, or the potatoes will be scabby. Never plant on soil known to produce common scab, such soil being usually alkaline. Clean potatoes are mostly produced on slightly acid soils.

Drainage is a very important requisite; it should be present naturally, or supplied artificially.

Use Certified Seed.—Use good type and large blocky seed pieces, certainly not less than $1\frac{1}{2}$ to 2 ounces each. To plant an acre with 2 ounce sets, in rows 36 inches apart and 12 inch spacing between plants, 30·2 bushels of seed is required. On land well supplied with organic matter, an abundant supply of available plant food and moisture, this quantity of seed will usually prove a profitable investment.

Treat seed before planting. Good tubers affected with scab and rhizoctonia can be made into good seed by proper seed-treatment. Seed-treatment cannot make satisfactory seed from off type and diseased culls.

Use a good planter; it costs more to care for a poor stand than it does for a good one.

Do not expose seed too long to the sun when planting; many poor stands of plants have resulted from over-exposure and too much drying of the sets.

Practise good cultural methods; keep down weeds and insects. Germinating tubers will not push up out of the ground if the soil has been deeply worked and good cultural practises followed.

Sufficient and proper spraying with Bordeaux mixture to prevent blights, and with arsenicals to control leaf-chewing insects, is an indispensable necessity where these pests occur. Spray thoroughly; half spraying will not pay; why waste time and money trying to prove it? Spray *before* the blight appears. Do not neglect the late spray.

Rogue early and often for diseases, and take out all suspicious looking plants and certainly all mixtures.

Potato tubers are thickened underground stems with numerous buds or eyes from which arise fresh shoots, thus reproducing vegetatively the potato plant. The life of a potato plant may be thus perpetuated year after year until mainly through disease it finally comes to an end. Careful experiments indicate that when potatoes are grown under favourable conditions, and cultural methods are good, they do not degenerate unless disease gets them.

Dig and handle the crop carefully to prevent damage. When digging the crop it is advisable to elevate a certain amount of soil in addition to the tubers,

to act as a buffer for the potatoes and protect them from coming into contact with the moving parts of the machine. As a general rule the digger should be operated slowly; there will be less cutting and bruising of the tubers if this is done. An uninjured tuber seldom rots, the unbroken skin of the potato being the best protection.

Storage

It is important to attain the highest efficiency in production, but it is equally important to keep the volume of supplies adjusted to the requirements of the market, as supply and demand vitally affects farm returns. A large percentage of the crop must be stored for several months and care is necessary during this period to prevent wastage.

The storage can be likened to a bank for the safe (temporary) holding of perishable stock in process of distribution. The crop held represents capital, labour and investment and it should be carefully protected from losses due to disease and frost damage. It has been estimated that 30 per cent of the crop is lost annually, during the storage period alone, from these causes.

The practical problem in the storage of potatoes is to prolong the life of the tubers and prevent heavy shrinkage and impairment of table qualities and seed values. Seed tubers in particular must be kept under ideal conditions for their full storage period, otherwise a loss in yield the following season is bound to result.

Successful storage of potatoes is dependent on a number of factors among which are the following: Soundness and freedom from mechanical injury of potatoes, size of the pile, temperature, humidity, aeration, and the exclusion of light. It is very important to start with carefully handled, dry, healthy stock, free from dirt. All skinned and wounded areas on tubers should be well corked over before the average storage temperature gets below 48-50 degrees F.

For long period storage potatoes require a storage temperature of 38-40 degrees F. but it is not necessary to hold them at this temperature when first dug. Somewhat higher temperatures during October and November are not harmful for healthy tubers and injuries will cork over more quickly at 50° F. From December on, 39° to 40° F. is the correct storage temperature and potatoes so stored will safely keep for six or seven months without sprouting or loss from rots and moulds. If it is desired to hold stock longer, the temperature can be lowered to 34°-38° F. when sprouting seems ready to start. Below 34° F. the potatoes become sweet, the starch-sugar change commencing. Above 38° F. the physiological activity of the potato increases—the respiration rate rises rapidly.

Humidity.—The humidity of the storage will probably vary considerably during the winter, but these changes do not appear harmful to the potato. Such variations as occur in ordinary winter weather may be disregarded. Conditions, however, which cause drying out of the potatoes should be avoided. Dirt floors are preferable owing to their effect upon the humidity of the storage. A relative humidity around 85 per cent is considered the best, but is likely to vary between 65 per cent and 95 per cent and without apparent injury. Humidities lower than 65 per cent should be avoided. Controlling the humidity content of the air during storage is apparently of minor importance for practical growers.

Respiration.—Bearing in mind that a potato is at all times active physiologically, i.e. a living organism, there are two periods during storage when respiration may become of practical importance. One of these is immediately after digging, and the other a period of several days following a sudden rise

in the storage temperature. To prevent sweating special attention should be given to the ventilation of potatoes handled in large bulk immediately after digging, and also after sudden rises in temperature following a period of steady cool storage. The lower the storage temperature, the higher the initial rate of respiration at a sudden higher temperature. Avoid sudden rises and falls in storage temperature.

Ventilation.—All possible air circulation should be provided in the early fall by keeping ventilators and doors open until there is danger of freezing. On warm days doors should be left closed and opened only at night when the air is cooler. The amount of ventilation required is that which will keep the potatoes dry. When there is danger of freezing at night the doors should be opened only during the day. From early December on all ventilators and doors should be closed and protected to prevent freezing. Respiration is very low during the steady cold weather and further aeration is usually unnecessary until warmer spring weather sets in.

Temperature, humidity, and aeration are interrelated. The amount of moisture given off by the tubers depends upon their temperature. As the temperature increases the respiration and transpiration increase and the oxygen requirements are greater. Ventilation supplies air, the necessary oxygen, and regulates the temperature and the humidity.

The storage cellar should be kept clean. Losses frequently occur due to rots which develop entirely as a result of putting potatoes in dirty and unsanitary bins. The storage should be so constructed as to make it easy to clean out all refuse. Before putting in new tubers, the floors, walls, and all bins should be thoroughly disinfected by whitewashing or by a copper sulphate solution, one pound to ten gallons of water. Unless this is done the fungi and bacteria which cause tuber rots may affect the stored potatoes.

A good storage house must be frost proof and well insulated to afford protection against cold and heat. In northern districts provision should be made for heating during very severe weather. All storage bins should be equipped with false floors with boards one inch apart and six inches above the main floor. The bins should be double walled to permit air circulation around and over the tubers. Not more than six hundred bushels should be stored in any one bin. In the case of large bins, ventilators one foot square and long enough to reach from the bottom to the top of the pile should be provided; these can be made cheaply from wooden slats. No potatoes should be further than five or six feet from a good supply of air. Potatoes in deep piles should be carefully watched for signs of sweating as the temperature rises in spring.

Tubers must be kept in the dark; if they are exposed to the light they will turn green. This is accompanied by the production of substances disagreeable to the taste, and sometimes even poisonous (solanin). In any case the cooking and eating qualities of the potato are affected. Much of the graying and blackening observed after cooking potatoes is due to improper, mainly too warm, storage conditions.

Publications on the Potato

For more detailed information on potato-growing and the diseases of the potato, etc. the following bulletins and circulars are available, and can be obtained free from the Publications Branch, Department of Agriculture, Ottawa:—

The Black Leg Disease of Potatoes.—Pamphlet No. 105, New series.

Late Blight and Rot of Potatoes.—Bulletin No. 119, New series.

Potato Scab.—Exhibition Circular No. 44.

Digging and Storing of Potatoes.—Pamphlet No. 15.

Root and Storage Cellars.—Pamphlet No. 10 New series.

List of Wholesale Dealers in Fruit and Vegetables—Bulletin No. 101.

Investigations of the Diseases of Potatoes.—Section V, Annual Report of the Dominion Botanist.

For special information on seed potato certification work inquiries may be addressed directly to the Dominion Botanist, Division of Botany, Central Experimental Farm, Ottawa, or locally as follows:—

Prince Edward Island—Senior Inspector, Dominion Laboratory of Plant Pathology, Charlottetown, P.E.I.

Nova Scotia—District Inspector, Dominion Laboratory of Plant Pathology, Kentville, N.S.

New Brunswick—District Inspector, Dominion Laboratory of Plant Pathology, Fredericton, N.B.

Province of Quebec—District Inspector, Dominion Laboratory of Plant Pathology, Ste. Anne de la Pocatière, P.Q.

Ontario—District Inspector, % Horticultural Department, Ontario Agricultural College, Guelph, Ont.

Manitoba and Eastern Saskatchewan—District Inspector, % Dominion Experimental Farm, Indian Head, Sask.

Western Saskatchewan and Alberta—District Inspector, Dominion Laboratory of Plant Pathology, University of Alberta, Edmonton, Alta.

British Columbia—District Inspector, Dominion Laboratory of Plant Pathology, Saanichton, B.C.

REGULATIONS UNDER DESTRUCTIVE INSECT AND PEST ACT, GOVERNING SEED POTATOES, P.C. 557

V. An inspector shall have the power to inspect before export to any foreign country, or shipment within the Dominion, any plant, and to grant a certificate according to the requirements of any country demanding such, or for domestic purposes.

All certificates so issued must bear a copy of the official seal of the plant disease or insect pest inspection service carried on under this Act.

In the case of potatoes, no person shall be allowed to sell, or offer, advertise, expose or hold in possession for sale, any potatoes in any manner or form described or designated as certified, inspected, registered, selected, disease free, or otherwise indicating their suitability for seed or seed purposes, unless such potatoes have been inspected in the field and after harvest by an inspector under the Destructive Insect and Pest Act and have been found sufficiently vigorous and free from serious diseases, to warrant them being classed into either of the two following grades, viz: Certified Seed Potatoes, Grade Extra No. 1, or Certified Seed Potatoes, Grade Small Sized (1½-3 ounces only).

Certified seed potatoes must be contained in sacks, barrels or other containers, to each of which shall be durably attached a certificate in the form of an authorized official tag, issued by an inspector, and bearing the grower's name or number.

It is an indictable offence under the Destructive Insect and Pest Act to advertise or sell, in Canada, uncertified potatoes as seed potatoes, or to use any kind of "seed" tag, likely to mislead an unsuspecting public. Growers, dealers and associations are permitted, however, to attach their own tags or brands, or mark any container of seed potatoes with any special description, but such may only be done when in addition the official certification tag is present on the container. Nothing in the foregoing is intended to convey the impression that only certified seed can lawfully be used for seed purposes. Any other kind of potatoes may be used freely by anyone but certified seed potatoes only may be advertised, sold, etc., as seed potatoes.

Value of Certified Seed

Commercial potato-growers whose stock is badly infested with diseases or contains mixed varieties would find it decidedly advantageous to secure certified seed.

It is not the chief purpose of the Department of Agriculture to encourage growers to use certified seed with a view to having their crops inspected for certification purposes, because every potato-grower has not the necessary patience and time, or suitable location and equipment for growing certified seed. The object rather is to have growers use the best seed obtainable for their commercial crop, and to help to keep down to a minimum destructive plant diseases with their resultant serious effect on yields. It is desirable to obtain greater acre yields and so to reduce the cost of production. The use of certified seed on many farms would double the yields now being obtained.

Notes for Purchasers of Certified Seed

Growers should clearly understand that certified seed does not mean seed potatoes that are entirely free from all diseases, for such a result is hardly possible under field conditions, but every effort is made to inspect and pass only tubers from fields that are well kept, and show only a very small percentage of disease, and where plants are vigorous and true to variety.

Seed potatoes must be in good condition before the official tags are attached to shipments, but the public must realize that potatoes cannot stand rough handling, high temperatures, or wet conditions in storage, as rot is almost sure to set in if such conditions prevail.

A comparison made between fields planted with certified seed and common stock of the same variety will convince the most sceptical that certified seed stock is far superior as regards freedom from disease, purity of variety, and vigour of growth, and that the resulting crop is better in every way. Many growers have stated that they will plant nothing but certified seed in future, and they are satisfied that such seed is worth paying a premium for. Purchasers of certified seed potatoes are requested to examine their potatoes as soon as received for grade and condition, and to ascertain that the official tag is attached. Complaints made weeks or months after storage cannot under any circumstances be entertained.

APPENDIX

Seed Potato Treatments

The tuber diseases for which seed treatment is recommended are rhizoctonia, scabs and blackleg. Apparently good control is possible if after seed treatment the tubers are kept clean and planted in clean soil. Seed treatment cannot be expected to be efficient if the tubers are subsequently planted in soil harbouring the organisms of disease.

Use dormant or only slightly sprouted whole tubers when treating; sprouted and cut tubers may be damaged by seed treatment.

Treatment should be given at least 15 days before planting.

NOTE.—It is considered unnecessary to treat seed that is bright and clean and practically free from disease, unless it has been allowed to become contaminated by contact with diseased stock. Clean certified seed can be planted with confidence in clean soil without seed treatment, and with reasonable assurance of a clean crop.

Formalin Treatments

Standard formalin treatment for Common Scab.—Immerse the potatoes for 2 hours in a solution of 1 pint of commercial formalin to 30 gallons of water. The solution may be used several times in succession; if left overnight, however, a fresh solution should be prepared. The cost of this treatment is approximately two cents per bushel.

Hot formalin treatment for Common Scab.—Use 1 pint of commercial formalin to 15 gallons of water. Heat to 121°-125° F. Soak the tubers for 2-3 minutes then pile them and cover for 1 hour, after which they should be spread to dry. This treatment should not be employed without the use of accurate thermometers since the temperature limits given must be rigidly held.

Formalin Gas Treatment for Common Scab.—Gas treatment is recommended only in cases in which liquid treatment is impracticable. Treatment must be carried out in an airtight compartment. Potatoes must be in crates or racks to allow gas penetration and potatoes should not be piled more than one foot deep. Tubers must be dry and kept at least 3 feet distant from the gas generator. Use 3 pints of commercial formalin and 23 ounces of potassium permanganate to 167 bushels of potatoes per 1,000 cubic feet of space. The permanganate is spread in a thin layer on the bottom of an iron or galvanized dish, the formalin poured over it and stirred quickly, then leave quickly and close doors tightly. The dishes used should have wide bottoms, and should be sufficiently deep to prevent the liquid from bubbling over when the gas is given off. The potatoes should be kept in the disinfecting chamber for 24-48 hours. The amount of potatoes to be disinfected must not be too small in proportion to the size of the chamber or injury will result to the tubers. A temperature inside the chamber of 60° F. or more is essential to thorough disinfection; it should not be allowed to fall below 50° F.

Corrosive Sublimate Treatments

Treatment with corrosive sublimate is recommended in preference to formaldehyde since the latter is ineffective in controlling rhizoctonia.

Standard Corrosive Sublimate treatment.—Immerse tubers for 1½ hours in a solution of corrosive sublimate, 4 ounces to 25 gallons of water. For successive lots add ½ ounce of chemical and more water to maintain the original

volume of the solution. A new solution should be prepared after the third or fourth soak. The temperature of the solution should be at least 60° F. but not over 80° F.

The potatoes should be soaked in clean water for 5 to 10 hours before treating to free them of soil, etc. Moistening the tubers before treatment in this manner is an aid in seed treatment as it permits the rhizoctonia sclerotia to be more easily and quickly killed.

Dry the tubers quickly after treatment by spreading them out on a clean floor or by using crates. After tubers are dry they should be left in the light and air until thick stubby sprouts are formed, when they are ready for planting.

Hot Corrosive Sublimate treatment.—Use 4 ounces of corrosive sublimate to 25 gallons of water. Heat to 126° F. Soak the tubers for 2 minutes then remove and dry. Care must be taken to keep the solution at the correct temperature and to maintain the solution at the initial strength.

Acidulated Corrosive Sublimate treatment formula.—A solution of corrosive sublimate (1-500) acidulated by the addition of 1 per cent by volume of commercial hydrochloric acid. Soak tubers for 5-10 minutes.

Considering the advantages of this treatment over the standard methods, the results obtained to date are sufficient to justify more extensive trials under varied field conditions. There is a saving of time, 5 minutes soak required instead of two hours. The use of hard water does not alter the effectiveness of the solution. Corrosive sublimate dissolves rapidly in the acidulated solution. No heating equipment necessary. Little damage or seed injury (tubers left in soak $\frac{1}{2}$ hour were uninjured). The solution can be used several times without changing.

Corrosive sublimate is obtainable in both the powder and the tablet form. For the standard treatment the chemical should first be dissolved in a gallon of boiling water and then added to the water to make up the treating solution. Soft water should be used where obtainable.

Caution.—Corrosive sublimate is a deadly poison. It should be kept out of reach of children, and in special bottles to avoid any possibility of mistaking it for anything else. Treated seed must not be used for feeding purposes. As the chemical is corrosive a wooden or earthenware container should be used, not a metal one.

Spray and Dusts

Spray—Bordeaux Mixture.—Bordeaux mixture is the standard fungicide for potatoes. It will control early blight, late blight, reduce the damage from tip burn and act as a repellent to leaf hoppers and flea beetles.

The mixture is a solution of bluestone, lime and water. The standard formula is bluestone (copper sulphate) 4 pounds, quicklime (stone lime) 4 pounds, water 40 gallons.

If stone lime is not available good hydrated lime may be substituted. One and one-third pounds of chemical hydrate or masons lime equals 1 pound stone lime. Agricultural hydrated lime is too coarse and gritty and often low in soluble calcium to be satisfactory. To be on the safe side use 6 pounds of the best hydrated lime to 4 pounds of bluestone in 40 gallons water. The lime should be left to stand for a few hours in the form of a thin paste before using.

To prepare 40 gallons of Bordeaux mixture, dissolve the 4 pounds of bluestone in 20 gallons of water in one vessel and make 20 gallons of lime water in another vessel, according to the formula, and pour the two lots simultaneously into the spray tank.

For larger quantities make stock solutions as follows. Bluestone (stock) solution—40 pounds bluestone dissolved in 40 gallons of water. Each gallon will contain 1 pound of bluestone. If the bluestone is suspended in a sack near the surface it will dissolve readily over night.

Lime (stock) solution—Slake 40 pounds stone lime, slowly until the lime is finely powdered, then add water gradually to make up 40 gallons. Each gallons will contain 1 pound of lime.

Keep stock solutions in wooden casks and covered to prevent evaporation. When making the Bordeaux mixture there is just one thing should never be done and that is to mix stock solutions together.

To prepare 40 gallons of Bordeaux, stir the stock solutions and pour 4 gallons of the bluestone solution into 16 gallons water in a cask, and four gallons of the milk of lime in 16 gallons water in another cask, and pour the two lots simultaneously into the spray tank.

Arsenic poison in the form of calcium arsenate may be added to exterminate Colorado beetles (potato bugs). Two pounds of the arsenate to 40 gallons of the Bordeaux should be sufficient if the spray is applied at the time the young beetles are hatching out. Most growers, however, add 8 ounces of Paris Green in addition for quick effect.

Bordeaux mixture should be applied at 250 pounds pressure for best results. Spray when the plants are 6 inches high and every 10 days throughout the growing season. Spray before rain.

Dusts

The generally used and accepted copper dust on the market now, consists of monohydrated copper sulphate and hydrated lime. This is inactive when stored as a mixed product in suitable metal containers but forms a Bordeaux mixture on the plants when sufficient moisture is present. The chemistry of the dust is essentially that of Bordeaux mixture and consequently properly made materials of this type are safe on potatoes.

Not all experimental workers agree on the effectiveness of the dusting method in the control of blights but most will agree that it has merit, especially for insect control. As a matter of fact the dusting of potatoes is increasing in popularity throughout the large potato growing areas, for it is a simple and quick method of applying the materials to the plants.

Machines of all types and sizes are now available for the work, from the small hand-blower type to the large engine-driven type which dusts four rows at a time, two nozzles to the row. The ease and timeliness of operation, the low rate of depreciation on the machinery, reduced labour cost, etc., appeals to the busy grower; against this, however, is an increased cost for materials.

Dusts may be purchased ready mixed, or the ingredients may be purchased separately and mixed at home. Poisons for insects are included with the copper dusts if desired or may be added when the proper season arrives.

Dusts should be applied after sun-down or early in the mornings when the air is still and before the dew dries off the plants. Applying dusts under windy and dry conditions is a waste of money. An average of about 25 pounds of dust per application per acre is necessary. Dust must be applied more frequently than spray.

